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औद्योगिक ऑटोमेशन शब्दावली

Indian Standard

INDUSTRIAL AUTOMATION GLOSSARY

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NATIONAL FOREWORD

This Indian Standard which is identical with ISO/TR 11065 : 1992 'Industrial automation glossary' issued by the International Organization for Standardization (ISO) was adopted by Bureau of Indian Standards on the recommendations of the Industrial and Production Automation Systems and Robotics Sectional Committee (MGP 18) and approval of the Medical Instruments, General and Production Engineering Division Council.

The text of the ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard
INDUSTRIAL AUTOMATION GLOSSARY

1 Scope

This Technical Report defines terms relevant to automation in an industrial manufacturing environment.

NOTES

1 All of the terms and definitions contained in this Technical Report have been obtained from the previously approved ISO publications listed in each case as the source. Numbers shown as |*N*| following each definition refer to the list of source documents provided in annex A.

2 A term printed in italic typeface in a definition or example has the meaning given to it in another entry of the vocabulary. However, the term is only printed in italic typeface the first time it occurs in each entry.

2 Glossary

(See following pages.)

abbreviated address calling: *Calling* that enables a user to employ an *address* having fewer *characters* than the full address when initiating a call. NOTE - Networks may allow a user to designate a given number of abbreviated address codes. The allocation of abbreviated address codes to a destination or group of destinations may be changed as required by means of a suitable procedure. | 8 |

absolute co-ordinates: The absolute distances or angles that specify the position of a point with respect to the datum of a co-ordinate system. | 2 |

absolute coordinate: One of the coordinates that identify the position of an *addressable point* with respect to the origin of a specified coordinate system. | 9 |

absolute error: The algebraic *result* of subtracting a true, specified or theoretically correct value from the computed, observed, measured or achieved value. | 2 |

absolute instruction: A *display command* using *absolute coordinates*. | 9 |

absolute position sensor: A *sensor* that gives directly the co-ordinate position of an element of a machine. | 2 |

absolute programming: Programming using *words* indicating *absolute dimensions* (absolute co-ordinates). | 2 |

absolute vector: A vector whose start and end points are specified in *absolute coordinates*. | 9 |

acceleration: Rate of change of the *velocity* at the point under consideration per unit of time. | 1 |

accuracy: A qualitative assessment of freedom from *error* or of the degree of conformity to a desired value, a high assessment corresponding to a small error. | 2 |

active accommodation: Type of control in which the combination of sensor outputs, control commands, and robot motion is used to achieve alteration of a robot's preprogrammed motions in response to sensed inputs (e.g, used to stop a robot when forces reach set levels, or to perform force feedback tasks like insertions, door opening and edge tracing). | 1 |

active devices: Devices which require a power supply independent of the value of input signals.
| 11 |

active output: Output the power of which in all possible states of the device is derived from supply power.
| 11 |

actual conditions: Conditions observed during operation.
| 11 |

actuator: A power mechanism used to effect motion of the robot (e.g. a motor which converts electrical, hydraulic or pneumatic energy to effect motion of the robot).
| 1 |

adaptive control: A control scheme that adjusts the control system parameters from conditions detected during the process.
| 1 |

A *control system* that adjusts the response from conditions detected during the work.
| 2 |

address (in numerical control): A *character*, or group of characters, at the beginning of a *word*, that identifies the *data* following in the *word*.
| 2 |

address block format: A *block format* in which each *word* contains an *address*.
| 2 |

address tabulation block format: A *tabulation block format* in which each *word* contains an *address*.
| 2 |

addressable point: Any point of a device that can be addressed.
| 9 |

aiming field: On a *display surface*, a circle or other pattern of light used to indicate the area in which the presence of a *light-pen* can be detected at a given time.
| 9 |

alignment function character: The *character* ":" used as the *address* character for a sequence number word that indicates a *block* in a *control tape* after which are recorded the *data* necessary for machining to be commenced or recommenced.
| 2 |

alignment pose: A specified *pose* of the *mechanical interface coordinate system* in relation to the *base coordinate system*.
| 1 |

ambient temperature: Temperature of the environment in which the apparatus is working.

| 11 |

amplification: Ratio between the output signal variations and the control signal variations (for analogue devices only).

| 11 |

amplifier: 1) See IEC Publication No. 50(37), 37.30.070. NOTE - Energy may be fluid power as well as electric energy.

| 11 |

analog data: *Data* represented by a physical quantity that is considered to be continuously variable and whose magnitude is made directly proportional to the data or to a suitable function of the data.

| 7 |

analog input channel amplifier: An amplifier attached to one or more *analog input channels*, that adapts the *analog* signal* level to the *input* range of the succeeding *analog-to-digital converter*.

| 10 |

analog input channel (in process control): The *analog data* path between the connector and the *analogto-digital converter* in the *analog* input subsystem*. NOTE - This path may include a filter, an analog *signal* multiplexer*, and one or more amplifiers.

| 10 |

analog output channel amplifier: An amplifier attached to one or more *analog* output* channels, that adapts the output *signal* range of the *digital-to-analog converter* to the signal level necessary to control the *technical process*. NOTE - If there is a common digital-to-analog converter in the subsystem, the amplifier performs the function of a *sample-and-hold device*.

| 10 |

analog representation: A representation of the value of a variable by a physical quantity that is considered to be continuously variable, the magnitude of the physical quantity being made directly proportional to the variable or to a suitable function of the variable.

| 7 |

analogue amplifier: *Amplifier* the output of which is continuously variable with the applied control signal.

| 11 |

anisochronous transmission: A *data transmission* process in which there is always an integral number of unit intervals between any two significant instants in the same group; between two significant instants located in different groups, there is not always an integral number of unit intervals. NOTE - In data transmission the group is a *block* or a *character*.

| 8 |

answering: The process of responding to a calling station to complete the establishment of a *connection* between *data stations*.

| 8 |

anti-vibration mounting: Device for insulating machine vibrations from the structure upon which it is mounted.

| 11 |

argument (in numerical control): *Data* which qualifies a *command*.

| 2 |

arm (primary axes): An interconnected set of links and powered joints comprising members of longitudinal shape which supports, positions and orientates the *wrist* and/or an *end effector*.

| 1 |

articulated structure: Set of links and joints which constitutes the *arm* and the *wrist*.

| 1 |

asynchronous transmission: *Data transmission* in which the time of occurrence of the start of each *character*, or *block* of characters, is arbitrary; once started, the time of occurrence of each *signal* representing a *bit* within the character, or block, has the same relationship to significant instants of a fixed time base.

| 8 |

attained pose: The pose achieved by the robot in response to the *command* pose.

| 1 |

automatic: Pertaining to a *process* or device that, under specified conditions, functions without human intervention.

| 4 |

automatic answering: *Answering* in which the called *data terminal equipment* (DTE) automatically responds to the calling *signal*. NOTE - The call may be established whether or not the called DTE is attended.

| 8 |

automatic calling (in a data network): *Calling* in which the elements of the *selection signal* are entered into the *data network* contiguously at the full *data signalling rate*. NOTE - The selection signal is generated by the *data terminal equipment*. A limit may be imposed by the design criteria of the network to prevent more than a permitted number of unsuccessful call attempts to the same *address* within a specified period of time.

| 8 |

automatic control: Control method which operates without human intervention.

| 11 |

automatic cycle: *Cycle* of operations which, once started, repeats indefinitely until stopped.

| 11 |

automatic mode: The *operating mode* in which the robot control system can operate in accordance with the *task program*.

| 1 |

automatic mode of operation: The mode of operation of a *numerically controlled* machine in which it operates in accordance with the control *data* until stopped by the *program* or the operator.

| 2 |

automation: The implementation of *processes* by *automatic* means.

| 4 |

axis: A direction in which a part of a robot can move in a linear or rotary mode. The number of axes is normally the number of guided and mutually independently driven links. Note - Axis is also used to describe a mechanism of a robot.

| 1 |

A direction in which a part of a machine can move in a linear or rotary mode.

| 2 |

backward channel: A *channel* associated with the *forward channel*, used for supervisory or *error control* signals*, but with a direction of transmission opposite to that of the forward channel in which user *information* is being transferred. NOTE - In case of simultaneous transfer of information in both directions, this definition applies with respect to the *data source* under consideration.

| 8 |

base: A platform or structure to which is attached the origin of the first member of the *articulated structure*.

| 1 |

base coordinate system: A coordinate system referenced to the *base* of the robot.

| 1 |

base mounting surface: The connection surface between the robot and its periphery upon which is defined the *base coordinate system*.

| 1 |

basic mode link control: Control of *data links* by use of the *control characters* of the ISO/CCITT 7 *bit * character set* for information interchange. NOTE - ISO Standard 646 and CCITT Recommendation V.3; ISO Standard 1745, Basic Mode Control Procedures.

| 8 |

bearer: Continuous longitudinal member underneath the top deck or between the top and bottom decks, which provides space for the entry of fork lift forks and pallet truck fingers.

| 3 |

bearer chord depth: Distance between the uppermost point of the notch and the top of the stringer [bearer].

| 3 |

bearer foot: Short bottom part of notched stringer [bearer] between notches and stringer [bearer] ends.

| 3 |

behind tape reader system btr (abbreviation): A feature of a *numerical control* system that can accept control data from a *control tape*, or alternatively from a *computer* or other source.

| 2 |

binary character: Each *character* of a *binary character set*. **Example:** T (true) or F (false), Y (yes) or N (no).

| 6 |

bit position: A *character * position* in a *word* in a *binary notation*.

| 7 |

blinking: An intentional periodic change in the intensity of one or more *display elements* or *segments*.

| 9 |

block: Short column (commonly rectangular or circular in section) underneath the top deck assembly or between the top and bottom deck assemblies which provides space for the entry of fork lift forks and pallet truck fingers.

| 3 |

block check: That part of the *error control* procedure used for determining that a *data * block* is structured according to given rules.

| 8 |

block delete: A facility that enables the operator to cause the *control system* to omit the execution of a *block* of *data* when the first *character* is a "/".

| 2 |

block diagram: A diagram of a system, a *computer*, or a device in which the principal parts are represented by suitably annotated geometrical figures to show both the basic functions of the parts and their relationships.

| 4 |

block format: The arrangement of the *words**, *characters* and *data* in a *block*.

| 2 |

block format specification: A specification identifying the *block format* and consisting of the three following parts: format classification general, expressed in a coded form; detailed format classification, expressed in a coded form; itemized data for the format contents and machine specifications.
| 2 |

bottom deck: Flat, horizontal mass-distributing surface, either slatted or solid.
| 3 |

box pallet: Pallet, with or without a lid, having a superstructure of at least three fixed, removable or collapsible vertical sides, solid, slatted or mesh, which generally permits stacking.
| 3 |

bridge input circuit (in process control): An *analog* input* circuit in which the sensing component of the technical process is in one branch of the bridge circuit and the reference components are in another branch.
| 10 |

burst transmission: *Data transmission* at a specific *data signalling rate* during controlled intermittent intervals.
| 8 |

call control procedure: The implementation of a set of *protocols* necessary to establish and release a call.
| 8 |

call-accepted signal: A call control *signal* that is sent by the called *data terminal equipment* to indicate that it accepts the incoming call.
| 8 |

call-not-accepted signal: A call control *signal* sent by the called *data terminal equipment* to indicate that it does not accept the incoming call.
| 8 |

calling: The process of transmitting *selection signals* in order to establish a *connection* between *data stations*.
| 8 |

cancel: A *command* that cancels a previously commanded *function*.
| 2 |

canned cycle: A pre-set series of operations which direct machine axis movement or cause spindle operation to complete such actions as boring, drilling, tapping or combinations thereof.
| 2 |

captive pallet: Pallet whose use cycle remains within a single firm or a closed distribution system.
| 3 |

chamfer: Bevel on the top edges of the bottom deck or bottom boards to facilitate the passage of finger-wheels of a pallet truck. It may also be applied to the bottom edges of the top deck.

| 3 |

character: A member of a set of elements that is used for the representation, organization, or control of *data*.

| 6 |

circuit switching: A process that, on demand, connects two or more *data terminal equipments* and permits the exclusive use of a *data circuit* between them until the *connection* is released.

| 8 |

clearance distance: The distance between the tool and the workpiece when the change is made from rapid approach to feed movement to avoid tool breakage.

| 2 |

clipping: Removing those *display elements* that lie outside a given boundary.

| 9 |

clock pulse: A periodic *signal* used for synchronization or for measuring intervals of time.

| 5 |

clockwise [right hand]: *Direction of rotation* of the hands of a clock.

| 11 |

clockwise arc: A circular path that is described by the reference point of a tool that rotates in a negative angular direction (as defined in ISO 841) about the centre of the path.

| 2 |

closed circuit: Circuit in which return fluid is directed to the pump inlet.

| 11 |

closed loop control system: An automatic *control system* incorporating power amplification and *feedback* that causes the value of an *output* variable to correspond closely to the value of an *input* quantity.

| 2 |

closed position: Valve position in which the inlet supply is not connected to an outlet.

| 11 |

Position of the valve member in which the *flow path* between *inlet* and *outlet ports* is closed.

| 11 |

closed user group: A group of specified users of a *data network* that is assigned a facility which permits them to communicate with each other but precludes communication with all other users of the service or services. NOTES 1 A user *data terminal equipment* may belong to more than one closed user group. 2 See figure 2.

| 8 |

closed user group with outgoing access: A *closed user group* that has a user to whom a facility is assigned which enables that user to communicate with other users of a *data network* transmission service where appropriate, that has users having a *data terminal equipment* connected to any other switched network to which interworking facilities are available, or both. NOTE - See figure 2.

| 8 |

code-independent data communication: A mode of *data communication* that uses a *character*-oriented *protocol* that does not depend on the *character set* or *code* used by the *data source*.

| 8 |

code-transparent data communication: A mode of *data communication* that uses a *bit*-oriented *protocol* that does not depend on the bit sequence structure used by the *data source*.

| 8 |

coded decimal notation (deprecated): A *binary-coded notation* in which each of the *decimal digits* is represented by a *binary numeral*. **Example:** In the binary-coded decimal notation that uses the *weights* 8-4-2-1, the number "twenty three" is represented by 0010 0011 (compare its representation 10111 in the *pure binary numeration system*).

| 7 |

coding scheme: A collection of rules that maps the elements of one set on to the elements of a second set. NOTES 1 The elements may be *characters* or *character strings*. 2 The first set is the *coded set* and the second is the *code element set*. 3 An element of the code element set may be related to more than one element of the coded set but the reverse is not true.

| 6 |

coil impedance: Complex ratio of coil voltage to coil current at specified conditions. It is important to note that the coil impedance may vary with signal frequency, amplitude and other operating conditions, for example, due to back e.m.f. generated by the moving armature.

| 11 |

collar: Detachable frame with solid, slatted or mesh sides, which may be fitted to a pallet or to another collar to retain the load.

| 3 |

combination diagram: Drawing using a combination of *graphical*, *cutaway* and *pictorial symbols* with interconnecting lines.

| 11 |

combinational circuit: A *logic device* whose *output* values, at any given instant, depend upon the *input* values at that instant. NOTE - A combinational circuit is a special case of a *sequential circuit* whose internal state is not taken in account.

| 5 |

combined station: In high level data link control (HDLC), the part of a *data station* that supports the combined control functions of the *data link* and that generates commands and responses for transmission and interprets received commands and responses. NOTE - Specific responsibilities assigned to a combined station include initialization of control *signal* interchange, organization of *data* flow, interpretation of received commands, and generation of appropriate responses and actions regarding *error control* and error *recovery* functions at the data link level.

| 8 |

command: An operative order which initiates a movement or a *function*. NOTE The order may be 1) direct input to the machine in coded form; 2) results from a logical interaction of *instructions* from an outside source with conditions sensed by the machine; 3) outputs derived from the computing or comparing function.

| 2 |

command mode: A mode of operation of the command or data entry device and display device in which entries are interpreted as *functions* to be executed.

| 2 |

command pose: A *pose* specified by *teach programming, manual data input programming* or *explicit programming*.

| 1 |

commissioning: Setting up, checking of the *robot system* and the verification of the robot functions following *installation*.

| 1 |

Act of operating, testing and adjusting a system or unit for the first time to ensure that it functions according to the specified performance. Functional tests will include the extremes of the required specification.

| 11 |

commissioning manual: Document detailing the quantity and type of fluid, electrical or other services and procedures to be followed before starting equipment for the first time. It will also detail the sequence of operations and observations to be made to ensure correct function of the equipment when first operated.

| 11 |

common mode rejection: The capability of a *differential amplifier* to suppress the effects of the *common mode voltage*.

| 10 |

complement: In a *fixed radix numeration system,* a number that can be derived from a given number by *operations* that include subtracting each *digit* of the *digital representation* of the given number from the corresponding digit of the digital representation of a specified number.

| 7 |

compliance: The flexible behaviour of a robot or any associated tool in response to external forces exerted on it. When the behaviour is independent of sensory feedback it is passive compliance ; if not it is active compliance.

| 1 |

computer graphics: Methods and techniques for converting *data* to or from graphic *displays* via *computers.*

| 9 |

computer output microfilming COM (abbreviation): A technique for converting and recording *data* from a *computer* directly onto a microform.

| 9 |

computer part programming: The preparation of a *part program* to obtain a *machine program* using a *computer* and appropriate *processor* and *post processor.*

| 2 |

computerization: *Automation* by means of *computers.*

| 4 |

computerized numerical control cnc (abbreviation): A *numerical control* system wherein a dedicated, stored program *computer* is used to perform some or all of the basic numerical control *functions.*

| 2 |

connection: An association established between *functional units* for conveying *information.*

| 8 |

contact bounce: An unwanted making and breaking of the connection while opening or closing a contact.

| 10 |

contact interrogation signal: A *signal* whose value indicates whether a contact is open or closed.

| 10 |

contention: A condition arising when two or more *data stations* attempt to transmit at the same time over a shared *channel,* or when two data stations attempt to transmit at the same time in *two-way alternate communication.*

| 8 |

continuous path control: A control procedure whereby two or more controlled motions operate in accordance with instructions that specify the next required *pose* (normally achieved through interpolation) and the required velocity to that pose. The velocity is varied for each *axis* motion so that the desired *path* is generated.

| 1 |

continuous working conditions: Conditions indicated by the values of the various factors which permit the unit to operate continuously. Continuous working conditions are indicated: q_c, p_c, etc. Often equals *rated (standard) conditions*.

| 11 |

contouring control system: *Numerical control* in which a) two or more numerically controlled motions operate in accordance with *instructions* that specify the next required position and the required *feedrates* to that position; b) these feedrates are varied in relation to each other so that a desired contour is generated.

| 2 |

control channel: Channel through which the control or input signal enters the device.

| 11 |

control character: A *character* whose occurrence in a particular context specifies a control function. NOTES 1 A control character may be recorded for use in a subsequent action. 2 A control character is not a *graphic character* but may have a graphic representation in some circumstances. 3 Control characters are described in ISO 646 and ISO 6429.

| 6 |

control console: Frame containing control *buttons*, switches, *levers*, etc. and necessary instrumentation, usually in the form of a desk with a vertical rear panel for gauges.

| 11 |

control panel: Vertical panel to carry gauges, switches and other control devices.

| 11 |

control program: The inherent set of control instructions which defines the capabilities, actions, and responses of a *robot system*. This type of program is fixed and usually not modified by the user.

| 1 |

control station: In *basic mode link control*, the *data station* that nominates the *master station* and supervises *polling*, *selecting*, *interrogating* and *recovery* procedures.

| 8 |

control system: An arrangement of elements interconnected and interacting so as to maintain some condition of a machine or so as to modify it in a prescribed manner.

| 2 |

control systems: Means whereby the *fluid power system* is controlled, linking that system to the operator and to control signal sources, if any. (See clause 6).

| 11 |

control tape: A *tape* on which a *machine program* is recorded.

| 2 |

controller: Device which senses a change of fluid state and automatically makes adjustments to maintain the state of the fluid between predetermined limits, for example pressures, temperatures, etc.

| 11 |

controls: See clause 6.

| 11 |

coordinate transformation: The process of changing the coordinates of a *pose* from one *coordinate system* to another.

| 1 |

counter-clockwise arc: A circular path that is described by the reference point of a tool that rotates in a positive angular direction (as defined in ISO 841) about the centre of the path.

| 2 |

cross fitting: Four-port *fitting* in the form of a cross.

| 11 |

curve generator: A *functional unit* that converts a *coded representation* of a curve into the graphic representation of the curve for *display*.

| 9 |

cutaway diagram: Drawing using *cutaway symbols* with interconnecting lines.

| 11 |

cutaway symbol: *Graphical symbol* in the form of a simplified drawing showing the essential internal design features of a component.

| 11 |

cutter compensation: A displacement normal to the cutter path, to adjust for the difference between actual and programmed cutter radii or diameters.

| 2 |

cycle: Execution of a *task program*.

| 1 |

cycle time: Time required to perform the *cycle*.

| 1 |

cylindrical robot: A robot whose mechanical structure of the *arm* comprises a *rotary joint* and two *prismatic joints*, whose axes are arranged in a cylindrical coordinate system.

| 1 |

dashpot: Hydraulic damping device which acts as a variable speed regulator for a pneumatic *cylinder*.

| 11 |

data: A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or *processing* by human beings or by *automatic* means.

| 4 |

data bank: A set of *data* related to a given subject and organized in such a way that it can be consulted by users.

| 6 |

data circuit: A pair of associated transmit and receive *channels* that provide a means of two-way *data communication*. NOTES 1 Between *data switching exchanges*, the data circuit may or may not include *data circuit-terminating equipment* (DCE), depending on the type of *interface* used at the data switching exchange. 2 Between a *data station* and a data switching exchange or *data concentrator*, the data circuit includes the data circuit-terminating equipment at the data station end, and may include equipment similar to a DCE at the data switching exchange or data concentrator location. 3 See figure 1.

| 8 |

data circuit transparency: The capability of a *data circuit* to transfer all *data* without changing the data content or structure.

| 8 |

data circuit-terminating equipment DCE (abbreviation): In a *data station*, the equipment that provides the *signal* conversion and coding between the *data terminal equipment* (DTE) and the *line*. NOTES 1 See figure 1. 2 The DCE may be separate equipment or an integral part of the DTE or of the *intermediate equipment*. 3 A DCE may perform other functions that are usually performed at the network end of the line.

| 8 |

data code (deprecated in this sense): The result of applying a *code* to an element in a *coded set*. Examples: 1 "CDG" as the representation of Paris Charles-De-Gaulle in the code for three-letter representation of airport names. 2 The seven *binary digits* representing the delete character in ISO 646.

| 6 |

data code set (deprecated in this sense): The result of applying a *code* to all elements of a *coded set*. Example: All the three-letter international representations of airport names.

| 6 |

data communication: Transfer of *information* between *functional units* by means of *data transmission* according to a *protocol*.

| 8 |

data concentrator: A *functional unit* that permits a common transmission medium to serve more *data sources* than there are *channels* currently available within the transmission medium.

| 8 |

data link: The assembly of parts of two *data terminal equipments* that are controlled by a link *protocol*, and the interconnecting *data circuit*, that enable *data* to be transferred from a *data source* to a *data sink*. NOTE – See figure 1.

| 8 |

data multiplexer: A *functional unit* that permits two or more *channels* to share a common transmission medium.

| 8 |

data network: An arrangement of *data circuits* and switching facilities for establishing *connections* between *data terminal equipments*.

| 8 |

data signalling rate: The aggregate of the number of *binary digits (bits)* per second in the transmission path of a *data transmission* system. NOTES 1 The data signalling rate is given by: where *m* is the number of parallel *channels*; *T_i is the minimum interval for the i*– th channel expressed in seconds; *n_i is the number of significant conditions of the modulation in the i*–th channel. 2 For a single channel (*serial transmission*) the rate is (1/*T*) log$_2$) *n*; with a two-condition modulation (*n* = 2), it is 1/*T*. 3 For parallel channels with equal minimum intervals and equal number of significant conditions on each channel, the rate is (*m*/*T*) log$_2$2; with a two-condition modulation, it is *m*/*T*.

| 8 |

data sink: The *functional unit* that accepts transmitted *data*.

| 8 |

data source: The *functional unit* that originates *data* for transmission.

| 8 |

data station: The *data terminal equipment* (DTE), the *data circuitterminating equipment*, and any *intermediate equipment*. NOTES 1 See figure 1. 2 The DTE may be connected directly to a *data processing system*, or may be part of it.

| 8 |

data switching exchange DSE (abbreviation): The equipment installed at a single location to perform switching functions, such as *circuit switching*, *message switching*, and *packet switching*.

| 8 |

data terminal equipment DTE (abbreviation): That part of a *data station* that serves as a *data source*, a *data sink*, or both. NOTE - See figure 1.

| 8 |

data transfer phase: That phase of a call during which user *data* may be transferred between *data terminal equipments* that are interconnected via the network.

| 8 |

data transfer rate: The average number of *bits*, *characters*, or *blocks*, per unit time passing between corresponding equipments in a *data transmission* system. NOTES 1 The rate is expressed in terms of bits, characters, or blocks, per second, minute, or hour. 2 Corresponding equipment should be indicated, such as *modems*, or *intermediate equipments*, or source and sink.

| 8 |

data transmission: The conveying of *data* from one place for reception elsewhere by telecommunication means.

| 8 |

data transmission channel: A means of one-way transmission. NOTE - A channel may be provided, for example, by frequency or time division *multiplexing*.

| 8 |

database: A *data* structure for accepting, *storing* and providing on demand data for multiple independent users.

| 6 |

datagram: In *packet switching*, a self-contained *packet*, independent of other packets, that carries *information* sufficient for routing from the originating *data terminal equipment* (DTE) to the destination DTE, without relying on earlier exchanges between the DTEs and the network.

| 8 |

datagram service: In *packet switching*, a service that routes a *datagram* to the destination identified in its *address* field without reference by the network to any other datagram. NOTE - Datagrams may be delivered to a destination address in a different order from that in which they were entered in the network.

| 8 |

dead band: The maximum range of the *input* quantity that does not cause a detectable change in the value of the *output* quantity.

| 2 |

dead time: The time between the beginning of a sudden and maintained change in value of the *input* quantity and the instant when the resulting change in the *output* quantity is perceptible.

| 2 |

decimal digit: A *digit* used in the *decimal numeration system*. Example: The Arabic digits 0 through 9.

| 6 |

decision table: A table of all contingencies that are to be considered in the analysis of a problem, together with the actions to be taken for each set of contingencies.

| 4 |

degree of freedom (DOF): One of the variables (maximum number of six) required to define the motions of a body in space. Note : Because of a possible confusion with axis, it is advised not to use the term "degree of freedom" for describing the motion of the robot.

| 1 |

delete character: A *control character* used primarily to obliterate an unwanted *character*.

| 2 |

delimiter: One or more *characters* used to indicate the beginning or the end of a *character string*.

| 6 |

demodulator: A *functional unit* that converts a modulated *signal* into the original signal.

| 8 |

demultiplexer: A device that recovers as *output* signals*, each of the signals combined by a preceding *multiplexer*.

| 10 |

device control character: A *control character* used to specify a control function for *peripheral devices* associated with a *computer system*. NOTE – Device control characters are described in ISO 646 and ISO 6429.

| 6 |

diagnostic function: The capability of a *functional unit* to detect problems and to identify the type of error.

| 10 |

differential amplifier: An amplifier that has two *input* circuits and that amplifies the difference between the two input *signals*.

| 10 |

differential pressure: Difference between *inlet* and *outlet pressure*, measured under specified conditions.

| 11 |

digit position: In a *positional representation*, each site that may be occupied by a *character* and that may be identified by an ordinal number or by an equivalent identifier.

| 7 |

digital: Pertaining to *data* that consist of *digits*.

| 4 |

digital data: *Data* represented by *digits*, perhaps with *special characters* and the *space character*.

| 7 |

digital representation: A *discrete representation* of *quantized* value of a variable, i.e. the representation of a number, by *digits*, perhaps with *special characters* and the *space character*.

| 7 |

direct call facility: A facility that permits *calling* without requiring the user to provide *address * selection signals*; the network interprets the call request *signal* as an instruction to establish a *connection* to one or more predetermined *data stations*. NOTE - This facility may permit a faster call set-up than usual. No special priority is implied over other users of the network establishing a connection. The designated addresses are assigned for an agreed period of time.

| 8 |

direct numerical control DNC (abbreviation): A system connecting a set of *numerically controlled* machines to a common memory for *part program* or *machine program* storage with provision for on-demand distribution of *data* to the machines. NOTE An operator panel allows the operator to direct the computer working in order to adjust programs.

| 2 |

direction of rotation: Direction of rotation is always quoted as viewed looking at the shaft end. In dubious cases, a sketch should be provided.

| 11 |

director: A *special purpose computer* that accepts *numeric data* as *input* and produces, as *output*, data in a form suitable for direct use by a *control system*.

| 2 |

discrete representation: A representation of *data* by *characters*, each character or a group of characters designating one of a number of alternatives.

| 7 |

displacement: Volume absorbed or displaced per *stroke* or *cycle*.

| 11 |

display console: A console that includes at least one *display surface* and may also include one or more *input devices*.

| 9 |

display group (deprecated): A collection of *display elements* that can be manipulated as a unit (see figure 1). NOTE - A segment may consist of several and separate dots, line segments, or other display elements.

| 9 |

display image: A collection of *display elements* or *segments* that are represented together at any one time on a *display surface* (see figure 1).

| 9 |

display instruction: A command that changes the state or controls the action of a *display device*.

| 9 |

display surface: In a *display device*, that medium on which *display images* may appear. Example: The screen of a cathode ray tube; the paper in a *plotter*.

| 9 |

disposable pallet: Pallet intended to be discarded after a single cycle of use.

| 3 |

dissolved air: Air dispersed at a molecular level in a *hydraulic fluid* and apparently forming only a single phase.

| 11 |

distance accuracy: Deviation in positioning and orientation between the command distance and the mean of the attained distances.

| 1 |

distance repeatability: Closeness of agreement between several attained distances for the same command distance repeated *n* times in the same direction.

| 1 |

distributed joint: An assembly between two rigid members which enables one to translate and/or rotate in relation to the other about an axis linked to the translation.

| 1 |

dot matrix character generator: A *character generator* that generates *character* images composed of dots.

| 9 |

dragging: Moving one or more *segments* on a *display surface* by *translating* it along a path determined by a *locator*.

| 9 |

drift of pose accuracy: Slow variation of the *attained pose* over a specified time.

| 1 |

drive shaft coupling: Device which connects two rotating shafts axially and transmits torque between them. (Usually permits a small degree of misalignment and sometimes provides torsional flexibility.)

| 11 |

drum plotter: A *plotter* that draws a *display image* on a *display surface* mounted on a rotating drum.

| 9 |

duplex cylinder: Unit comprising two *cylinders* with independent control, mechanically connected on a common axis to provide three or four positions depending on the method of application.

| 11 |

duplex transmission: *Data transmission* in both directions at the same time.

| 8 |

dwell: A time delay of established duration, not cyclic or sequential; it does not constitute an interlock or hold.

| 2 |

effective data transfer rate: The average number of *bits*, *characters*, or *blocks*, per unit time transferred from a *data source* to a *data sink* and accepted as valid. NOTE - The rate is expressed in bits, characters, or blocks, per second, minute, or hour.

| 8 |

efficiency: Ratio of an output to the corresponding input.

| 11 |

elbow fitting: *Fitting* shaped to form an angle between mating lines and having a connection port at each end. The angle is always 900, unless otherwise stated.

| 11 |

electrical flow transducer: Device which converts fluid flow to an electrical signal.

| 11 |

electrical pressure transducer: Device which converts fluid pressure to an electrical signal.

| 11 |

electrostatic plotter: A *raster ploter* that uses a row of electrodes to fix the inks electrostatically on the paper.

| 9 |

emergency control: Device, usually manual, fitted to a valve or circuit providing an alternative method of control in the case of failure of the normal method of control.

| 11 |

emergency stop: A condition which overrides all other robot controls, removes drive power from robot axis *actuators*, and initiates the stopping of all moving parts, and removes power from other dangerous functions controlled by the robot.

| 1 |

emulation: The imitation of all or part of one system by another, primarily by *hardware* so that the imitating system accepts the same *data*, executes the same *programs*, and achieves the same results as the imitated system.

| 4 |

enabling signal: A *signal* that permits the occurrence of an event.

| 5 |

end of block character: A control *character* that indicates the completion of a *block* of input data.

| 2 |

end of program: A *miscellaneous function* indicating completion of a *program*. Cancels spindle and coolant function after completion of all *commands* in the *block*. Used to *reset* control and/or machine. Resetting control may include rewind of *tape* to the program start *character* or progressing a loop tape through the splicing leader.

| 2 |

end of tape: A *miscellaneous function* which *cancels* spindle and coolant after completion of all *commands* in the *block*. Used to reset control and/or machine. Resetting control will include rewind of *tape* to the program start *character*, progressing a loop tape through the splicing leader or transferring to a second *tape reader*.

| 2 |

end-effector: A device specifically designed for attachment to the *mechanical interface* to enable the robot to perform its task (e.g. gripper, nutrunner, welding gun, spray gun).

| 1 |

end-effector coupling device: A flange at the end of the articulated structure (3.5) and locking devices or additional parts securing the end effector (3.11) to the end of the articulated structure.

| 1 |

equipment temperature: Temperature of the unit at a specified position and measured at a specified point.

| 11 |

error: A discrepancy between a computed, observed or measured value or condition and the true, specified or theoretically correct value or condition.

| 2 |

error control: That part of a *protocol* controlling the detection, and possibly the correction, of errors.

| 8 |

error range: The set of values that an *error* may take.

| 2 |

error span: The magnitude of the difference between the extreme values of an *error range.*

| 2 |

exchange pallet: Pallet which can be replaced by a like pallet on the basis of mutual agreement.

| 3 |

executive program (in numerical control): In computer-based numerical control systems, the *instruction* sequence which establishes the operating capabilities of the system.

| 2 |

explicit programming: Programming method in which the *poses* of the end-effector or the desired *path* are explicitly defined (e.g. CAD/CAM).

| 1 |

failsafe operation: The operation of a *computer system* such that in case of failure of a component, the probabilities of loss of equipment, damage to equipment, and harm to personnel are reduced.

| 10 |

fan-in ratio: Number of control inputs available on a device.

| 11 |

fan-out ratio: Number of identical devices which can be controlled by the output of a device.

| 11 |

fast select: An option of a *virtual call facility* that allows the inclusion of *data* in call-set-up and call-clearing *packets.*

| 8 |

feed function: A specification of feed rate.1)

| 2 |

feedback: The transmission of *information* from one stage in a *control system* to a stage situated before it.

| 2 |

Means whereby the state of the controlled element is signalled.

| 11 |

feedrate bypass: A manual function that directs the *control system* to ignore the programmed feedrate and to substitute a selected value.

| 2 |

feedrate override: A facility enabling the feedrate to be modified.

| 2 |

female thread: *Connection* with internal thread.
| 11 |

file: A named set of *records* **stored* or processed as a unit.
| 6 |

file maintenance: The activity of updating or reorganizing a *file*.
| 6 |

filter pressure drop: Difference in pressure across the filter at any given time.
| 11 |

fitting: Leakproof device to connect pipelines (conductors) to one another, or to equipment.
| 11 |

fixed block format: A *block format* in which the number of *words* in a *block* is constant; the words in a block occur in a constant order; the number of *characters* in a word in any one position in the block is constant.
| 2 |

fixed sequence manipulator: A *manipulator* which performs each step of a given operation according to a predetermined motion pattern which cannot be changed without physical alteration.
| 1 |

flange connection: *Connection* consisting of a pair of flanges (sealed) one on each component to be connected.
| 11 |

flared fitting: Type of *fitting* in which the connection is made with the aid of a tubing nut and a special tool which expands the end of the tubing to provide a seal against the end of the fitting which does not require any sealing compound and may be threaded male or female.
| 11 |

flash point: Temperature at which the fluid shall be heated to give off sufficient vapour to cause it to ignite in the presence of air when a small flame is applied under controlled conditions.
| 11 |

flatbed plotter: A *plotter* that draws a *display image* on a *display surface* mounted on a flat surface.
| 9 |

flicker: An undesirable pulsation of a *display image* on a cathode ray tube.
NOTE – Flicker occurs when the *regeneration rate* is too low with respect to the phosphor characteristics.
| 9 |

flip-flop: A *trigger circuit* that has two *stable states*.

| 5 |

floating zero: A characteristic of a *numerical control* system that permits the origin of the numerical control measuring system to be placed in any position relative to the *machine datum*, the location of a permanent origin not necessarily being stored in the numerical control system..

| 2 |

floating-point representation (system): A *numeration system* in which a *real number* is represented by a pair of distinct *numerals*, the real number being the product of the fixed-point part, one of the numerals, and a value obtained by raising the implicit floating-point base to a power denoted by the *exponent* in the *floating-point representation*, indicated by the second numeral.

| 7 |

floating-point representation: A representation of a *real number* in a *floating-point representation system*. Example: A floating-point representation of the number 0.0001234 is: 0.1234 -3 where: 0.1234 is the fixed-point part -3 is the exponent. The numerals are expressed in the *variable-point * decimal numeration system*.

| 7 |

flow amplification: Ratio between the *output flow* and the *input* (control) *flow*.

| 11 |

flow control: In *data communication*, control of the *data transfer rate*.

| 8 |

flow diagram: A graphical representation in which *symbols* are used to represent such things as *operations, data, flow* and equipment, for the definition, analysis, or solution of a problem.

| 4 |

flow path: See 5.2.3.

| 11 |

flow rate: Quantity (volume or mass to be specified) of a fluid crossing the transverse plane of a *flow path* per unit time. Air volume rate shall be expressed at *standard reference atmospheric conditions*.

| 11 |

flowline: A line representing a connecting path between the *symbols* in a *flowchart* to indicate a transfer of *data* or control.

| 4 |

flowlines: Pipelines (conductors) for transferring the working fluid.

| 11 |

flowmeter: Device which directly indicates the *flow rate* of a fluid.

| 11 |

fluidic amplifier: *Amplifier* which is designed for use in fluidic systems. | 11 |

fluidics: Signal sensing and information processing or energy control with fluid using components without moving parts. | 11 |

force: Force transmitted by the piston rod. | 11 |

forward channel: A *channel* in which the direction of transmission is the direction in which user *information* is being transferred. | 8 |

four-way pallet: Pallet permitting the entry of fork lift forks or pallet truck fingers from all four directions. | 3 |

free entry: Entry through which the finger-wheels of a pallet truck can pass without leaving the ground. | 3 |

friction head: *Head* necessary to overcome fluid friction. | 11 |

full perimeter base pallet: Pallet which has the outer bottom deckboards arranged as a complete frame and with one or two centre boards. All boards are in the same plane. | 3 |

functional design: The specification of the functions of the components of a system and of the working relationships among them. | 5 |

gantry robot: A robot whose mechanical structure includes a gantry. | 1 |

gear motor: Motor in which two or more gears act in engagement as working members. | 11 |

general purpose processor: A *computer program* which carries out computations on the *part program* and prepares the cutter location data (CL data) for a particular part without reference to machines on which it might be made. | 2 |

goal directed programming: Programming method in which the task to be carried out is defined but the *path* of the *end-effector* is not prescribed. Note : the terms defined above are sometimes incorrectly referred to as "on-line programming" and "off-line programming" and this is to be discouraged. | 1 |

graphic character: A *character*, other than a *control character*, that has a visual representation and is normally produced by writing, printing or *displaying*.

| 6 |

graphical representation: Diagrammatic means of conveying information about the function of components and circuits.

| 11 |

gripper: An *end-effector* designed for seizing and holding.

| 1 |

guard: Safety device, usually of sheet metal or wire mesh, which protects personnel from injury by moving machine parts, for example, pump drive shafts, shafts, *cylinder* rods.

| 11 |

half-duplex transmission: *Data transmission* in either direction, one direction at a time.

| 8 |

hard copy: A *document* that can be read without magnification or other technical aids and that is usually portable. NOTE - Hard copies are commonly used to reproduce the *image* displayed.

| 4 |

hardware: Physical equipment, as opposed to *programs*, *procedures*, rules, and associated documentation.

| 4 |

harmonic response: Changes, under *steady-state conditions*, in the output variable which are caused by a sinusoidal input variable.

| 11 |

head: Height of a column or body of fluid above a datum expressed in linear terms (often used to express gauge pressure).

| 11 |

heat exchanger (fluid cooler): See 5.6.

| 11 |

heat exchangers: Devices which lower, maintain or raise the temperature of the working medium by heat exchange with another fluid.

| 11 |

hidden line: A line segment that represents an edge obscured from view in a two-dimensional projection of a three-dimensional object.

| 9 |

highway: In a *process computer system*, the means for interconnection between the *computer system* and the *process interface system*. NOTE - A *bus* may be used as a highway.

| 10 |

hold: A state in which the robot operation is interrupted but can be resumed without special procedure.

| 1 |

home position: A fixed point along an *axis* referenced with respect to a *machine datum*. Typically used for tool change and pallet change.

| 2 |

hybrid computer: A *computer* that can process both *analog data* and *digital data*.

| 4 |

hydraulic accumulator: *Accumulator* containing a fluid under pressure and capable of storing hydrostatic energy to do useful work.

| 11 |

hydraulic amplifier: Fluid device which acts as an *amplifier*. Hydraulic amplifiers may utilize sliding spools, flapper-nozzles, *jet* pipes, etc.

| 11 |

hydraulic control: *Pressure control* using liquid in a *pilot control line*.

| 11 |

hydraulic feedback: *Feedback* using a hydraulic circuit.

| 11 |

hydraulic stepping motor: *Hydraulic motor* which follows the commands of a stepped input signal to achieve positional accuracy.

| 11 |

hysteresis: Difference in controlled parameters, at the same control setting, when adjusting the quantity upwards and then downwards or vice versa.

| 11 |

hysteresis: Difference in the valve *input signals* required to produce the same valve output during a single *cycle* of valve input signal when cycled at a rate below that at which dynamic effects are important; it is expressed as a percentage of the *rated signal*. Maximum hysteresis is normally indicated and is the maximum difference in input signal occurring in a cycle shown as a percentage of rated signal.

| 11 |

identity element: A *gate* that performs an *identity operation*.

| 5 |

if-and-only-if element: A *gate* that performs the *Boolean operation* of *equivalence*.

| 5 |

if-then element: A *gate* that performs the *Boolean operation* of *implication*.
| 5 |

image regeneration: The sequence of events needed to generate a *display image* from its representation in *storage*.
| 9 |

impulse: A variation in the value of a magnitude, short in relation to the time schedule of interest, the final value being the same as the initial value.
| 5 |

impulse generator: Device so arranged that, if a continuous pneumatic signal is applied to the *input port*, a single pulse is produced at the *output port*.
| 11 |

increment size: The distance between adjacent *addressable points* on the *display surface*.
| 9 |

incremental coordinate: A *relative coordinate* where the previously addressed point is the reference point.
| 9 |

incremental position sensor: A *sensor* that directly measures the movement of an element of a machine in terms of its change of position.
| 2 |

incremental programming: Programming using *words* indicating incremental dimensions (incremental co-ordinates).
| 2 |

indirect pressure control: Control method in which the position of the moving parts is controlled by a change of the control pressure to a pilot device.
| 11 |

individual axis acceleration: Acceleration when generating the movement of one individual *axis*.
| 1 |

individual axis velocity: Velocity when positioning with the movement of one individual *axis*.
| 1 |

information processing: The systematic performance of *operations* upon data. Examples: Handling, *merging*, *sorting*, computing, *assembling*, *compiling*. NOTE - Data processing may be performed by human beings or *automatic* means; in the latter case, it is often referred to as "automatic data processing" or "ADP".
| 4 |

inhibiting signal: A *signal* that prevents the occurrence of an event.
| 5 |

initial position: A fixed point along an *axis* and which may be referenced with respect to a *machine datum*. Typically used for start-up.
| 2 |

Position of the valving element after main pressure is admitted and before the intended operating *cycle* begins under the influence of the actuating *forces*.
| 11 |

initial starting: Specified sequence of operations for starting a unit or system for the first time or re-starting after *maintenance*, repair or long period of shut- down. Includes functional verification.
| 11 |

initialization: A sequence of operations establishing the starting conditions of a machine.
| 2 |

inking: Creating a line by moving a *locator* over the *display surface* leaving a trail behind the locator in the manner of a pen drawing a line on paper.
| 9 |

inlet flow: *Flow rate* crossing the transverse plane of the *inlet port*.
| 11 |

inlet temperature: *Fluid temperature* at the plane of the *inlet port*.
| 11 |

input primitive: An item of *data* obtained from an *input* device such as a keyboard, *choice device*, *locator*, *pick device*, or *valuator*.
| 9 |

input protection: For *analog input channels*, the protection against overvoltages that may be applied between any two *input* connectors or between any input connector and ground.
| 10 |

input signal: Effective current to the valve which produces a given output.
| 11 |

input subsystem: That part of a *process interface system* that transfers *data* from the *technical process* to the *process computer system*.
| 10 |

installation: The operation consisting of installing the robot on its site, connecting it to its supply and drive powers.
| 1 |

installation manual: Document detailing all materials and *services* required, mounting facilities, relative disposition of units and means of connecting equipment in preparation to *commissioning* and starting up of a new *installation* or piece of equipment.

| 11 |

intelligent: Pertaining to a device of a *functional unit* that is partially or totally controlled by one or more integral *processors*.

| 4 |

interface: A shared boundary between two *functional units*, defined by functional characteristics, common physical interconnection characteristics, *signal* characteristics, and other characteristics, as appropriate. NOTE - The concept involves the specification of the *connection* of two devices having different functions.

| 8 |

interlock bypass: A *command* to circumvent temporarily a normally provided interlock.

| 2 |

intermediate equipment: Auxiliary equipment that may be inserted between the *data terminal equipment* and the *signal* conversion equipment to perform certain additional functions before modulation or after demodulation.

| 8 |

interpolation (in numerical control): The determination of points intermediate between known points on a desired path or contour in accordance with a given mathematical function, for example linear, circular or higher order functions.

| 2 |

interpolation parameters: Parameters defining the portion of the cutter path that is to be interpolated.

| 2 |

interrogating: The process whereby a *master station* requests a *slave station* to indicate its identity or its status.

| 8 |

isochronous transmission: A *data transmission* process in which there is always an integral number of unit intervals between any two significant instants.

| 8 |

joint coordinate system: A coordinate system referenced to the joint axes, the joint coordinates of which are defined relative to the preceding joint coordinates or to some other coordinate system.

| 1 |

joy stick: A lever with at least two degrees of freedom, that is used as an *input* device, normally as a *locator*.

| 9 |

joystick: A manual controlled device whose variable position and orientation or applied forces are measured and result in commands to the robot control system.

| 1 |

latch: Moving parts are retained in a fixed position by means of a locking device which cannot be released until certain specified conditions are fulfilled.

| 11 |

layout character /gb/: A *control character* used to position printed, *displayed*, or recorded *data*. NOTE - Format effectors are described in ISO 646 and ISO 6429.

| 6 |

lead board: Deckboard located at the edge of the pallet.

| 3 |

leakage: Flow leaking past *seals* doing no useful work.

| 11 |

learning control: A control scheme whereby experience (obtained during previous cycles) is automatically used to change control parameters and/or algorithms.

| 1 |

length: Deck dimension in direction of stringers [bearers] or stringerboards. If these members are not present, the length is the longer dimension. (See *L* in the figure.) NOTE - The length dimension is quoted first when designating the pallet size.

| 3 |

letter: A *graphic character* that, when appearing alone or combined with others, is primarily used to represent a sound element of a spoken language. NOTE - Diacritical marks used alone and punctuation marks are not letters.

| 6 |

life expectancy: Predicted working period during which a component or system will maintain a specified level of performance under specified conditions. Sometimes expressed in statistical terms as a probability.

| 11 |

light button: *Display elements* used to simulate a function key by means of a *pick device*.

| 9 |

light-pen: A light-sensitive *pick device* that is used by pointing it at the *display surface*.

| 9 |

light-pen hit: The sensing by a *light-pen* of light generated by a *display element* on a *display surface.*

| 9 |

limiting load: The maximum *load* which can be applied to the *mechanical interface* without any damage or failure to the robot mechanism, under restricted operating conditions in comparison to *rated load* conditions.

| 1 |

line (in numerical control): A portion of *machine program* or *sub-program* equivalent to one *block* of NC data. Lines are separated by NEW LINE (LINE FEED) code. Sequence numbers contained in NC data are not necessarily equivalent to line numbers. The definition of line numbers in a given situation is a function of control implementation.

| 2 |

line graphics: *Computer graphics* in which *display images* are generated from *display commands* and coordinate data.

| 9 |

line motion control system: *Numerical control* in which a) each numerically controlled motion operates in accordance with *instructions* which specify both the next required position and the required *feedrate* to that position; b) the movements in the different axes of motion are not co-ordinated with each other; c) the movements in the different axes of motion take place only parallel to linear, circular or other machine ways. NOTE There is a type of numerically controlled machine that has the characteristics of line motion control but in which required feedrates for the next required position can be effected in two axes of linear motion simultaneously. A straight-line path may thus be generated that is not parallel to the machine ways.

| 2 |

linear list: A linearly ordered set of *data elements* whose order is preserved in *storage* by using sequential allocation.

| 6 |

linear motor: *Cylinder* (see 3.5).

| 11 |

Cylinder with built-in control unit by which the piston rod is automatically reciprocated.

| 11 |

linked list: A *list* in which the *data elements* may be dispersed in *storage* but in which each data element contains information for locating the next one.

| 6 |

liquid contamination: *Contamination* in liquid form expressed in terms of mass per mass of supplied air or gas.

| 11 |

list: An ordered set of *data elements*.

| 6 |

list processing: A method of processing *data* in the form of *lists*. NOTE - *Chained lists* are usually used so that the order of the *data elements* can be changed without altering their physical locations.

| 6 |

load: The load is a function of mass, moment of inertia, static and dynamic forces supported by the robot and is expressed as the force and torque at the *mechanical interface* which can be exerted along the various *axes* of motion under specified conditions of velocity and acceleration.

| 1 |

load pressure drop: Differential pressure between the *control ports*. This is denoted as a positive pressure if the higher of the two values is connected to *supply pressure* and the lower to return. A negative value implies that the highest of the load pressures is connected to *return pressure* and the lower to supply. Thus a positive pressure drop denotes an opposing load implying a flow of energy to the actuator while a negative load pressure drop denotes an assisting load implying absorption of energy from the actuator.

| 11 |

locator: An *input* device that provides coordinates of a position. Examples: A *mouse*, a *tablet*.

| 9 |

logic design: A *functional design* that uses formal methods of description, such as *symbolic logic*.

| 5 |

logic device: A device that performs *logic operations*.

| 5 |

logic diagram: A graphic representation of a *logic design*.

| 5 |

logic element: A *combinational circuit* that performs an elementary *logic operation*. NOTE - The term "gate" generally involves one output.

| 5 |

logic symbol: A *symbol* that represents an *operator*, a *function*, or a functional relationship.

| 5 |

logic threshold: Minimum number of signals required at the inputs of a multi-input device to change the output condition.

| 11 |

logical record: A set of related *data elements* considered to be a *record* from a logical viewpoint.
| 6 |

machine datum: The built-in zero positions of the machine elements.
| 2 |

machine home: A condition in a machine co-ordinate system where all machine elements are at the *home position.*
| 2 |

machine program: An ordered set of *instructions* in automatic control *language* and *format,* recorded on appropriate *input media* and sufficiently complete to effect the direct operation of an automatic control system.
| 2 |

machine program data: *Data* conforming to the *format* and interpreted according to the provisions of ISO 6983.
| 2 |

machine tool reference position: The physically predetermined positions of the machine tool axes used with incremental *control systems* to set the *initial position.*
| 2 |

machine word: A *word* usually treated as a unit, that is suitable for processing by a given *computer.*
| 6 |

main frame (deprecated): A *functional unit* that consists of one or more *processors* and their *internal storages.* NOTE - In English, the term **processor** is often used synonymously with **processing unit.**
| 4 |

maintenance manual: Document detailing the disciplines and procedures to be followed to maintain an item of equipment, complete machine or system in good working order. It will detail periodic checks and replacement of parts, type of lubricant and protective processes and the period of time between each check. It will include instructions on how to locate faults, carry out repairs and the replacement of components. It may also include a detailed list of the components which go together to make the complete unit, and their reference numbers and quantity required to assist purchase of replacements as required.
| 11 |

majority element: A *gate* that performs a *majority operation.*
| 5 |

manipulating industrial robot: An automatically controlled, reprogrammable, multi-purpose, manipulative machine with several *degrees of freedom*, which may be either fixed in place or mobile for use in industrial automation applications. Notes 1: The following is an explanation of terms used in the above definition: - reprogrammable: whose programmed motions or auxiliary functions may be changed without physical alterations; - multi-purpose: can be adapted to a different application with physical alteration; - physical alteration means alteration of the mechanical structure or control system except for changing programming cassettes, ROMs, etc. 2: For the purposes of the remaining sections of this vocabulary, the term "robot" will mean "manipulating industrial robot". | 1 |

manipulator: A machine, the mechanism of which usually consists of a series of segments jointed or sliding relative to one another, for the purpose of grasping and/or moving objects (pieces or tools) usually in several *degrees of freedom*. It may be controlled by an *operator*, a programmable electronic controller, or any logic system (e.g. cam device, wired, etc.).

| 1 |

mantissa (in a floating-point representation): In a *floating-point representation*, the *numeral* that is multiplied by the exponential implicit *floating-point base* to determine the *real number* represented. Example: See the example of entry 05.04.02.

| 7 |

manual answering: *Answering* in which a call is established only if the called user signals a readiness to receive the call by means of a manual operation.

| 8 |

manual calling (in a data network): *Calling* that permits the entry of *selection signals* from a calling *data station* into the *line* at an undefined *character* rate. NOTE - The characters may be generated at the *data terminal equipment* or the *data circuit-terminating equipment*.

| 8 |

manual control: Control device which is manually operated.

| 11 |

manual cycle: *Cycle* which is always under human control.

| 11 |

manual data input mode of operation: Single *block* operation that includes the entry of *numerical control * data* by hand.

| 2 |

manual data input programming: Program generation and entry directly into the robot control system by means of switches or plug-boards or keyboards.

| 1 |

manual mode: The *operating mode* in which the robot can be operated by, for example, push buttons or *joystick*.
| 1 |

manual mode of operation: Non-automatic operation of a machine in which the operator controls it without the use of *numeric data*, for example by push-button or joystick control.
| 2 |

manual part programming: The manual preparation of a *machine program* for a part. NOTE It is possible to use the *computer* processor to produce coordinate values and then prepare the *machine program* manually.
| 2 |

master station: In *basic mode link control*, the *data station* that has accepted an invitation to ensure a *data* transfer to one or more *slave stations*. NOTE - At a given instant, there can be only one master station on a *data link*.
| 8 |

maximum allowable common mode overvoltage: The highest value of the *common mode voltage* that can be applied to an *input subsystem* without causing circuit damage, but with the possibility of a temporary loss of function. NOTES 1 If it is clear from the context, this term may be shortened to "Maximum allowable overvoltage". 2 The following relationship exists: the *maximum common mode voltage* is lower than the *maximum operating common mode voltage* which is lower than the "maximum allowable common mode overvoltage".
| 10 |

maximum allowable normal mode overvoltage: The highest value of the *normal mode voltage* that can be applied to an *input subsystem* without causing circuit damage, but with the possibility of a temporary loss of function. NOTES 1 If it is clear from the context, this term may be shortened to "Maximum allowable overvoltage". 2 The following relationship exists: the *maximum normal mode voltage* is lower than the *maximum operating normal mode voltage* which is lower than the "maximum allowable normal mode overvoltage".
| 10 |

maximum common mode voltage: The highest value for the *common mode voltage* at which the subsystem will still operate according to its specifications. NOTE - The following relationship exists: the "maximum common mode voltage" is lower than the *maximum operating common mode voltage* which is lower than the *maximum allowable common mode overvoltage*.
| 10 |

maximum normal mode voltage: The highest value for the *normal mode voltage* at which the subsystem will continue to operate according to its specifications. NOTE - The following relationship exists: the "maximum normal mode voltage" is lower that the *maximum operating normal mode voltage* which is lower than the *maximum allowable normal mode overvoltage*.
| 10 |

maximum operating common mode voltage: The highest value for the *common mode voltage* that can be applied to an *input subsystem* and at which the subsystem will continue to operate, but at reduced performance. NOTES 1 If it is clear from the context, this term may be shortened to "Maximum operating voltage". 2 The following relationship exists: the *maximum common mode voltage* is lower than the "maximum operating common mode voltage" which is lower than the *maximum allowable common mode overvoltage*.

| 10 |

maximum operating normal mode voltage: The highest value for the *normal mode voltage* that can be applied to an *input subsystem* and at which the subsystem will continue to operate, but at reduced performance. NOTES 1 If it is clear from the context, this term may be shortened to "Maximum operating voltage". 2 The following relationship exists: the *maximum normal mode voltage* is lower than the "maximum operating normal mode voltage" which is lower than the *maximum allowable normal mode overvoltage*.

| 10 |

maximum space: The *motion space* plus the space which can be swept by the *end-effector* and the workpiece.

| 1 |

maximum thrust: The maximum thrust that can be continuously applied to the *mechanical interface* (excluding any inertial effect), assuring no permanent damage to the robot mechanism.

| 1 |

maximum torque: The maximum torque that can be continuously applied to the *mechanical interface* (excluding any inertial effect) assuring no permanent damage to the robot mechanism.

| 1 |

mean rate accuracy: Error margin, excluding errors caused by noise at input, which should not be exceeded when a device is used under normal operating conditions.

| 10 |

mechanical control: Control method which is operated by mechanical elements, such as, shaft, cam, lever, etc.

| 11 |

mechanical feedback: *Feedback* using a mechanical transmission.

| 11 |

mechanical interface coordinate system: A coordinate system referenced to the mechanical interface.

| 1 |

mechanical interface: The mounting surface at the end of the *articulated structure* adjacent to the *end-effector*.

| 1 |

mechanical seal: *Sealing device* in which the sealing action is aided by mechanical force and which comprises contact surface having relative movement. These surfaces can be in various materials such as metal, carbon, ceramics, etc.

| 11 |

message switching: In a *data network*, the process of routing messages by receiving, storing, and forwarding complete messages.

| 8 |

minimum positioning time: Time elapsing between departure from and arrival of the *mechanical interface* stationary state when traversing a predetermined distance or sweeping through at predetermined angle (positioning and orientation time, including stabilization time).

| 1 |

mirror image switch: A switch the operation of which causes the programmed coordinats applied to one or several axes to be multiplied by - 1.

| 2 |

mirroring: One hundred and eighty degrees of rotation of *display elements* about an axis in the plane of the *display surface*.

| 9 |

miscellaneous function: A *command* which controls discrete *functions* of machine or *control systems*. NOTE For example, coolant on, spindle off, or coolant stop.

| 2 |

mixed base notation (deprecated in this sense): A *radix numeration system* in which the *digit places* do not all necessarily have the same *radix*. Example: The *numeration system* in which three successive *digits* represent hours, tens of minutes, and minutes; taking one minute as the unit, the *weights* of the three digit places are 60, 10 and 1 respectively; the radices of the second and third digit places are 6 and 10 respectively. NOTES 1 A comparable numeration system that used one or more digits to represent days and two digits to represent hours would not satisfy the definition of any radix numeration system, since the ratio of the weights of the "day" and the "tens of hours" digit places would not be an integer. 1 See also note 1 to 05.03.15.

| 7 |

mixed radix notation (deprecated in this sense): A *numeration system* in which a number is represented as the sum of a series of terms each of which consists of a mantissa and a *base*, the base of a given term being constant for a given application but the bases being such that there are not necessarily integral ratios between the bases of all the terms. Example: With bases b_3, b_2 and b_1 and the mantissae 6, 5, and 4, the number represented is given by: $6b_3 + 5b_2 + 4b_1$ NOTES 1 A *mixed radix numeration system* is the particular base of a mixed base numeration system in which, when the terms are *ordered* so that their bases are in descending magnitudes, there is an integral ratio between the base of adjacent terms, but not the same ratio in each case; thus if the smallest base is b and if x and y represent *integers*, the *numeral* 654 in such a numeration system represents the number given by: $6xyb + 5\ xb + 4b$ 2 A *fixed radix numeration system* is the particular case of a mixed base numeration system in which, when the terms are ordered so that their bases are in descending magnitudes, there is the same integral ratio between the bases of all pairs of adjacent terms; thus if b is the smallest base and if x represents an integer, the numeral 654 in such a numeration system represents the number given by: $6\ x^2b + 5\ xb + 4b$

| 7 |

mobile robot: A robot mounted on an automatically movable *base*. Example: A mobile robot is a gantry mounted robot which is a robot whose base is mounted on the carriage of a gantry.

| 1 |

MODEM: A *functional unit* that modulates and demodulates *signals*. NOTES 1 One of the functions of a modem is to enable *digital data* to be transmitted over analog transmission facilities. 2 The word MODEM is a contraction of *MOdulator-DEModulator*.

| 8 |

modulation rate: The reciprocal of the measure of the shortest nominal time interval between successive significant instants of the modulated *signal*. NOTE - If this measure is expressed in seconds, this rate is given in bauds.

| 8 |

modulator: A *functional unit* that converts a *signal* into a modulated signal suitable for transmission.

| 8 |

motion space: The space which can be swept by the moving parts of the robot, excluding the *end-effector* and the workpiece.

| 1 |

mouse: A hand held *locator* operated by moving it on a surface. NOTE - A mouse generally contains a *control ball* or pair of wheels.

| 9 |

multi-directional pose accuracy: Deviation between the different mean *attained poses* achieved when visiting the same *command pose* n times from three perpendicular directions.

| 1 |

multiplexer: A device that takes several *input* signals* and combines them into a single *output* signal in such manner that each of the input signals can be recovered.

| 10 |

multiplexing: In *data transmission*, a function that permits two or more *data sources* to share a common transmission medium such that each data source has its own *channel*.

| 8 |

multipoint connection: A *connection* established among more than two *data stations* for *data transmission*. NOTE - The connection may include switching facilities.

| 8 |

multirange amplifier: An amplifier that has a switchable, programmable, or automatically set amplification factor in order to adapt different *analog* signal* ranges to a specified *output* range.

| 10 |

nand element: A *gate* that performs the *Boolean operation* of *nonconjunction*.

| 5 |

neutral phase: Initial and ultimate *phase* of a *cycle*.

| 11 |

node: In a *data network*, a point where one or more *functional units* interconnect *channels* or *data circuits*.

| 8 |

noise: A disturbance that affects a *signal* and that may distort the *information* carried by the signal.

| 10 |

noise: Random fluctuations of the signal level which may cause undesirable *spurious signals* in a circuit.

| 11 |

non-isolated amplifier: An amplifier that has an electrical connection between the *signal* circuit and another circuit including ground.

| 10 |

non-reversible pallet: Doubledeck flat pallet with only one loadcarrying surface.

| 3 |

normal mode rejection: The capability of an amplifier to suppress the effect of the *normal mode voltage*.

| 10 |

normal mode voltage: That unwanted part of the voltage, between the two *input* connection points of an amplifier, that is added to the voltage of the original *signal*.

| 10 |

normal operating conditions: The range of the environmental conditions (such as temperature, humidity etc.) and other effects which may influence robot performance (such as electrical supply instability, electromagnetic fields etc.) within which the performance of the robot specified by the manufacturer is valid.

| 1 |

normal operating state (automatic operation): The robot state in which the robot is performing its programmed tasks through continuous program execution without fault.

| 1 |

normalised device coordinate: A *device coordinate* specified in an intermediate coordinate system and normalised to some range, typically 0 to 1. NOTE - A *display image* expressed in normalised device coordinates lies in the same relative position on any *device space.*

| 9 |

not element: A *gate* that performs the *Boolean operation* of *negation.*

| 5 |

not-if-then element: A *gate* that performs the *Boolean operation* of *exclusion.*

| 5 |

notation: A *set* of *symbols*, and rules for their use, for the representation of *data.*

| 7 |

notch: Cut-out in the lower part of a stringer [bearer], providing fork entry at right angles to the stringer [bearer].

| 3 |

null string: A *string* that contains no element.

| 6 |

numeric data: *Data* represented by *numerals.*

| 7 |

numerical control NC (abbreviation): *Automatic* control of a *process* performed by a device that makes use of *numeric data* usually introduced while the operation is in progress. NOTE - The term **numerical control** is commonly used in machinetool applications.

| 4 |

one-way communication: *Data communication* such that *data* is transferred in one preassigned direction.

| 8 |

open loop numerical control system: A *control system* in which there is no *feedback* of the position value in the form of a *signal* from a *transducer.*

| 2 |

operating mode: A state of the robot control system.

| 1 |

operating space: That portion of the *device space* corresponding to the area available for displaying images.

| 9 |

operating system: *Software* that controls the *execution* of *programs* and that may provide services such as *resource allocation, scheduling, input/ output* control, and *data* management. NOTE - Although operating systems are predominately software, partial or complete *hardware* implementations are possible.

| 4 |

operational control data: Data conforming to the *format* and interpreted according to the provisions of the standard proposed in TR 6132.

| 2 |

operational space: The portion of the *restricted space* that is actually used while performing the programmed motions.

| 1 |

operational statement: A *command* consisting of a function mnemonic followed by one or more *arguments* or groups of arguments that qualify the command.

| 2 |

operator: A competent person designated to start, monitor and stop the intended productive operation of a robot or *robot system*.

| 1 |

optimization: A process whose object is to make one or more variables assume, in the best possible manner, the value best suited to the operation in hand, dependent on the values of certain other variables which may be either predetermined or sensed during the operation.

| 2 |

optional stop: A *miscellaneous function * command* similar to a program stop except that the control ignores the command unless the operator has previously validated the command.

| 2 |

oriented spindle stop: A *miscellaneous function* that causes the spindle to stop at a predetermined angular position.

| 2 |

output primitive: A basic graphic element that can be used to construct a *display image* (see figure 1). Examples: A dot, a line segment.

| 9 |

output subsystem: That part of a *process interface system* that transfers *data* from the *process computer system* to a *technical process*.

| 10 |

override: A manual control function that enables the operator to modify programmed values (for example, of feedrates or spindle speeds).

| 2 |

packet: A sequence of *binary digits*, including *data* and control *signals*, that is transmitted and switched as a composite whole. NOTE - The data, control signals, and possibly *error control information*, are arranged in a specific *format*.

| 8 |

packet assembler/disassembler PAD (abbreviation): A *functional unit* that enables *data terminal equipments* not equipped for *packet switching* to access a packet switched network.

| 8 |

packet mode terminal: *Data terminal equipment* that can control, format, transmit, and receive *packets*.

| 8 |

packet sequencing: A process of ensuring that *packets* are delivered to the receiving *data terminal equipment* (DTE) in the same sequence as they were transmitted by the sending DTE.

| 8 |

packet switching: The process of routing and transferring *data* by means of addressed *packets* so that a *channel* is occupied only during the transmission of a packet; upon completion of the transmission, the channel is made available for the transfer of other packets.

| 8 |

panning: Progressively *translating* the *display image* to give the visual impression of lateral movement of the image. NOTE - Panning may be restricted to a viewport.

| 9 |

parallel: Pertaining to a *process* in which all events occur within the same interval of time, each one handled by a separate but similar *functional unit*. Example: The parallel transmission of the *bits* of a *computer word* along the lines of an internal *bus*.

| 5 |

parallel transmission: The simultaneous transmission of the *signal* elements of a group representing a *character* or other entity of *data*.

| 8 |

part program: An ordered set of *instructions* in a language and in a *format* required to cause operations to be effected under *automatic control*, which is either written in the form of a *machine program* on an *input medium* or prepared as input *data* for processing in a *computer* to obtain a *machine program*.

| 2 |

passive station: On a *multipoint connection* or a *point-to-point connection* using *basic mode link control*, and *tributary station* waiting to be polled or selected.

| 8 |

path: Spacial locus drawn by the movement of any point on the robot or the workpiece, along which orientation of the robot *end-effector* may or may not be variable.

| 1 |

path acceleration: The resultant acceleration obtained under *continuous path control* which generates the acceleration along several *axes* in such a way that the *mechanical interface* or specified *tool centre point* (TCP) reaches the desired *velocity* along required *path*.

| 1 |

path accuracy: Ability of a robot to have its *mechanical interface* following the command *path* in the same direction *n* times.

| 1 |

path repeatability: Closeness of the agreement between the attained *paths* for the same command path repeated *n* times.

| 1 |

path velocity: The velocity along a specified *path* obtained under *continuous path control* which generates the velocity components along several *axes*.

| 1 |

path velocity accuracy: The error between the command velocity and the mean value of *n* replications of the attained velocity measured at the *mechanical interface*.

| 1 |

path velocity fluctuation: Maximum deviation in velocity during one replication with one command velocity.

| 1 |

path velocity repeatability: Closeness of agreement of the velocities attained under the same conditions.

| 1 |

pendular robot: A robot whose mechanical structure of the *arm* includes a universal joint pivoting subassembly.

| 1 |

peripheral device: With respect to a particular *processing unit*, any equipment that provides the processing unit with outside communication. Examples: input/output units, auxiliary storage.

| 4 |

pick device: An *input* device used to specify a particular *display element* or *segment*. Example: A *light-pen*.

| 9 |

picture element PEL (abbreviation): The smallest element of a *display surface* that can be independently assigned colour or intensity.

| 9 |

planning sheet: A list of operations for the manufacture of a part, prepared before the *part program*.

| 2 |

playback robot (record playback robot): A robot that can repeat a *task program* which is entered through *teach programming*.

| 1 |

plotter step size: The *increment size* on a *plotter*.

| 9 |

plotting head: That part of a *plotter* used to create marks on a *display surface*.

| 9 |

point-to-point connection: A *connection* established between two *data stations* for *data transmission*. NOTE - The connection may include switching facilities.

| 8 |

polar (spherical) robot: A robot whose mechanical structure of the arm comprises two *rotary joints* and a *prismatic joint*, whose axes are arranged in a polar coordinate system.

| 1 |

polling: On a *multipoint connection* or a *point-to-point connection*, the process whereby *data stations* are invited one at a time to transmit.

| 8 |

pose: Combination of position and orientation of a part of a robot (e.g. its *mechanical interface*) or of a workpiece in a *coordinate system*.

| 1 |

pose accuracy: Deviation between a *command pose* and the mean of the *attained poses* when approaching the command pose from the same direction.

| 1 |

pose repeatability: Closeness of agreement between the positions and orientations of the *attained poses* after n repeat visits to the same *command pose* in the same direction.

| 1 |

pose stabilization time: Period of time which ellapses between the instant at which the robot gives the "*attained pose*" signal and the instant at which the damped oscillatory motion or the damped motion of the *mechanical interface* lies within a specified limit.

| 1 |

pose-to-pose control: A control procedure whereby each motion operates in accordance with instructions which specify only the next *pose*. The movements of the different *axes* may not be coordinated with each other and may be executed simultaneously or consecutively. Velocities may not be specified by the input data.

| 1 |

positioning control system: *Numerical control* in which a) each numerically controlled motion operates in accordance with *instructions* which specify only the next required position; b) the movements in the different axes of motion are not co- ordinated with each other and may be executed simultaneously or consecutively; c) velocities are not specified by the *input* data.

| 2 |

post processor: A computer *program* which adapts the output of a *processor* into a *machine program* for the production of a part on a particular combination of machine tool and *controller*.

| 2 |

precision: A measure of the ability to distinguish between nearly equal values. Example : Four-*digit* numbers are less precise than six-digit numbers; nevertheless, a properly computed four-digit number may be more accurate than an improperly computed six-digit number.

| 2 |

preparatory function: A *command* which establishes a functioning mode of machine or *control system*. NOTE For example, interpolation type, fixed cycle, threading, or dimensional units.

| 2 |

primary station: In high level data link control (HDLC), the part of the *data station* that supports the primary control functions of the *data link*, generates commands for transmission, and interprets received responses. NOTE - Specific responsibilities assigned to the primary station include initialization of control *signal* interchange, organization of *data* flow, and actions regarding *error control* and error *recovery* functions.

| 8 |

prismatic joint; sliding joint:: An assembly between two rigid members enabling one to have a linear motion in contact with the other.

| 1 |

process: A course of events defined by its purpose or by its effect, achieved under given conditions.

| 4 |

process computer system: A *computer system*, with a *process interface system*, that monitors or controls a *technical process*.

| 10 |

process control: The control of a *process* in which a *computer system* is used to regulate usually continuous operations or processes.
| 4 |

process control equipment: Equipment that measures the variables of a *technical process*, directs the process according to control *signals* from the *process computer system*, and provides appropriate signal transformation. Examples: sensors, transducers, actuators.
| 10 |

process interface system: A *functional unit* that adapts *process control equipment* to the *computer system* in a *process computer system*.
| 10 |

process interrupt signal: A *signal* that originates from a *technical process* and that causes an *interrupt* in the *process computer system*.
| 10 |

program (deprecated in this sense): A *program*, called by another program, that may have some general or frequent use.
| 4 |

program stop: A *miscellaneous function* command to cancel the spindle and coolant functions and terminate further processing after the completion of other *commands* in the *block*.
| 2 |

programmer: A competent person designated to prepare the *task program*.
| 1 |

programming: The designing, writing, and testing of *programs*.
| 4 |

programming language: An *artificial language* designed to generate or to express *programs*.
| 4 |

protocol: A set of semantic and syntactic rules that determines the behaviour of *functional units* in achieving communication.
| 8 |

pushdown stack: A *list* that is constructed and maintained so that the next *data element* to be retrieved is the most recently *stored*. NOTE - This method is characterized as "last in, first out" (LIFO).
| 6 |

raster display device: A *display device* in which *display images* are generated by *raster graphics*.
| 9 |

raster graphics: *Computer graphics* in which a *display image* is composed of an array of *pixels* arranged in rows and columns.
| 9 |

raster plotter: A *plotter* that generates a *display image* on a *display surface* using a line-by-line scanning technique.
| 9 |

raster unit: The unit of measure equal to the distance between adjacent *pixels*. NOTE - This term has been used in the past to denote *increment size*.
| 9 |

rate [level] of contamination: Every result of measurement characterizing the *contamination* of a fluid in the form of one number. The criterion adopted in this case could be: either a numeration of *particles*, or the measurement of the major physical characteristic (mass, surface after deposit on the filter). Thus it could be called "rate of pollution" of a qualitative kind or "numerical, gravimetric, photometric...".
| 11 |

rated load: The maximum *load* that can be applied to the *mechanical interface* in *normal operating conditions* without degradation of any advertised performance specification. The rated load includes the inertial effects of the *end-effector*, accessories and workpiece (where applicable).
| 1 |

read-out: A display showing *data* in the form of *characters*.
| 2 |

recognition time: The time elapsed between the change of the value of a *digital* input* signal* and its recognition by a digital input device.
| 10 |

recovery: A process in which a specified *data station* resolves conflicting or erroneous conditions arising during the transfer of *data*.
| 8 |

recovery function: The capability of a *functional unit* to resume normal operation after a *failure*.
| 10 |

recovery time: When sending or receiving *pulses*, the time required between the end of a pulse and the beginning of the next pulse. NOTE - The term usually applies to the equipment that sends or receives pulses.
| 10 |

rectangular [cartesian] robot: A robot whose mechanical structure of the *arm* comprises three *prismatic joints*, whose axes are arranged in a cartesian coordinate system.
| 1 |

reference block: A *block* that contains the *alignment function character* and all the *data* necessary to commence or recommence the execution of the work.
| 2 |

refresh: The process of repeatedly producing a *display image* on a *display surface* so that the image remains visible.
| 9 |

refresh rate: The number of times per second at which a *display image* is produced for *refresh.*
| 9 |

relative coordinate: One of the coordinates that identify the position of an *addressable point* with respect to another addressable point.
| 9 |

relative error: The ratio of an *absolute error* to the true, specified or theoretically correct value of the quantity affected by this *error.*
| 2 |

relative instruction: A *display command* using *relatives coordinates.*
| 9 |

relative vector (deprecated): A vector whose end point is specified as a displacement from its start point.
| 9 |

remote centre compliance device (RCC): A compliant device with remote centre used to interface a robot to its *end- effector* or working medium. Note - The remote centre compliance device allows a gripped part to rotate about its tip or to translate without rotating when pushed laterally at its tip.
| 1 |

remote control system: *Control system* in which the operating station is distant from the *fluid power system.*
| 11 |

repeatability: The closeness of agreement between successive *results* obtained when a specified operation is performed a specified number of times at one set-up. It may be expressed as the *error range* for a specified number of measurements with a probability of 95%.
| 2 |

reproducibility: The closeness of agreement between individual *results* obtained when a specified operation is performed on similar or different pieces of equipment not at one set-up. It may be expressed as the *error span* between two individual results with a probability of 95%.
| 2 |

resolution: The smallest distance or angle that can be effected by each *axis* of the robot.
| 1 |

The least interval between two adjacent discrete details that may be distinguished one from the other. Examples : 1 Of a measuring system, the smallest measurable increment. 2 Of a *control system*, the smallest controllable increment of movement.

| 2 |

Increment of *input signal* required to produce a change in valve output at a specified signal level, expressed as a percentage of *rated signal*. Resolution is normally specified as the minimum signal required to cause either an increase or a decrease of *valve* output. If these signals differ, the larger of the two should be quoted.

| 11 |

response time: The time between the beginning of a sudden and maintained change in values of the *input* quantity and the instant when the resulting change in the *output* quantity for the first time reaches a specified large fraction of the steady-state change in value subsequently obtained.

| 2 |

restricted space: The portion of the *maximum space* that is restricted by limiting devices that establish limits that will not be exceeded in the event of any foreseeable failure of the *robot system*. Note : The maximum distance that the robot can travel after the limiting device is actuated shall be considered the basis for defining the restricted space.

| 1 |

reverse clipping: Suppression of all the *display elements* that lie within a given boundary.

| 9 |

revolute [articulated] robot: A robot whose mechanical structure of the *arm* comprises three *rotary joints*.

| 1 |

rise time: In the approximation of a step function, the time required for a *signal* to change from a specified low value to a specified high value. NOTE - Usually these values are 10% and 90% of the step height.

| 10 |

robot system: A robot system includes: the robot (hardware and software) consisting of the *manipulator* whether mobile or not ; power supply and control system ; the *end-effector(s)*; any equipment, devices, or sensors required for the robot to perform its task ; any communication interface that is operating and monitoring the robot, equipment, or sensors, as far as these peripheral devices are supervised by the control system.

| 1 |

robotics: Designing, building, and applying robots.

| 1 |

rolling: *Scrolling* restricted to an upward or downward direction.
| 9 |

rotary joint: An assembly connecting two rigid members which enables one to rotate in relation to the other, about a fixed axis.
| 1 |

rotation (in computer graphics): Turning *display elements* about a fixed axis.
| 9 |

rubber-banding: Moving the common ends of a set of straight lines while the other ends remain fixed.
| 9 |

sample-and-hold device: A device that senses and stores the instantaneous value of an *analog* signal*.
| 10 |

scaling (in computer graphics): Enlarging or diminishing all or part of a *display image*. NOTE - Scaling does not have to be carried out with the same factor in all directions.
| 9 |

Scara robot: A *revolute robot* whose axes of the *rotary joints* of the *arm* are vertical, with horizontal *compliance*.
| 1 |

scrolling: Moving a *window* vertically or horizontally in such a manner that new *data* appear within the *viewport* as old data disappear.
| 9 |

secondary station: In high level data link control (HDLC), the part of a *data station* that executes *data link* control functions as instructed by the *primary station* and that interprets received commands and generates responses for transmission.
| 8 |

selecting: On a *multipoint connection* or a *point-to-point connection*, the process of requesting one or more *data stations* to receive *data*.
| 8 |

selection signal: In a switched network, the sequence of *characters* that indicates all the *information* required to establish a call.
| 8 |

semi-automatic cycle: *Cycle* which, after being started, completes one cycle and stops at the initial position.
| 11 |

sensor: A unit which is actuated by a physical quantity and which gives a *signal* representing the value of that physical quantity.
| 2 |

sensors: Devices that enable a system to detect and transmit changes in external conditions.

| 11 |

sensory control: A control scheme where the robot motion or force is adjusted in accordance with outputs of external sensors.

| 1 |

sequence control: A system of control in which a series of machine movements occurs in a desired order, the completion of one movement initiating the next, and in which the extent of the movement is not specified by *numeric data*.

| 2 |

sequential: Pertaining to a *process* in which all events occur one after the other, without any time lapse between them.

| 5 |

sequential circuit: A *logic device* whose *output* values, at a given instant, depend upon its *input* values and the internal state at that instant, and whose internal state depends upon the immediately preceding input values and the preceding internal state. NOTE - A sequential circuit can assume a finite number of internal states and may therefore be regarded, from an abstract point of view, as a finite automation.

| 5 |

serial: Pertaining to a *process* in which all events occur one after the other. Example: The serial transmission of the *bits* of a *character* according to the V24 CCITT protocol.

| 5 |

serial transmission: The *sequential* transmission of the *signal* elements of a group representing a *character* or other entity of *data*.

| 8 |

servo control: Control method in which a signal representing the required state of the controlled element is compared with a signal representing the actual state the controlling element takes up a position determined by the difference between these signals.

| 11 |

servo stability: The capability of a *servo-system* to restore the *output* value to its equilibrium value, without oscillation or with damped oscillation, after this value has been disturbed.

| 2 |

servo-mechanism: A *servo-system* in which the controlled variable is a mechanical position or any of its derivatives with respect to time.

| 2 |

settling time: Following the initiation of a specified *input* signal* to a system, the time required for the *output* signal to enter and remain within a specified narrow range centered on its steady-state value. NOTE - The input may be a step, impulse, ramp, parabola, or sinusoid. For a step or impulse, the range is often specified as 1 2% of the final steady-state value.
| 10 |

shaft extension: That part of the drive shaft which extends outside the unit and which includes the means whereby the drive is effected; for example, key, taper spline, etc.
| 11 |

signal: A variation of a physical quantity used to convey *data*.
| 4 |

signal-to-noise ratio: Ratio of the value of the signal to that of the noise.
| 11 |

simplex transmission: *Data transmission* in one pre-assigned direction only.
| 8 |

simulation: The representation of selected behavioral characteristics of one physical or abstract system by another system. Examples: a) The representation of physical phenomena by means of *operations* performed by a *data processing system*. b) The representation of operations of a data processing system by those of another data processing system.
| 4 |

single block mode of operation: The mode of operation of a *numerically controlled* machine in which, at the initiation of the operator, it operates in automatic mode of operation for one *block* of control *data* only.
| 2 |

slave station: In *basic mode link control*, the *data station* that is selected by a *master station* to receive *data*.
| 8 |

soft copy: A nonpermanent *display image*. Example: A cathode ray tube display.
| 9 |

software: Intellectual creation comprising the programs, procedures, rules and any associated documentation pertaining to the operation of a *data processing system*. NOTE - Software is independent of the carrier used for transport.
| 4 |

spare parts: Component parts, sub-assemblies or complete assemblies, identical to or interchangeable with those in a system, held in store to carry out a repair or maintenance operation with the minimum of delay.
| 11 |

spare parts list: Document detailing the quantity and type of components, sub-assemblies and unit recommended by the equipment manufacturer to be held in store for *preventive maintenance* and general repair to keep the equipment in good working condition.

| 11 |

spindle speed function: A specification of spindle speed.1)

| 2 |

spine robot: A robot whose mechanical structure of the *arm* is made up of one or more sets of cells each pivoting around the centre of the preceding one.

| 1 |

spring return: Moving parts of the unit are returned to the initial position by spring force after the actuating forces have been removed.

| 11 |

stable state: In a *trigger circuit*, a state in which the circuit remains until the application of a suitable *pulse*.

| 5 |

standard cycle: A sequence of movements by a robot during a typical task considered as reference under specified conditions.

| 1 |

start signal: In *start-stop transmission*, a *signal* at the beginning of a *character* that prepares the receiving device for the reception of the *code* elements. NOTE - A start signal is limited to one signal element generally having the duration of a unit interval.

| 8 |

start-stop transmission: *Asynchronous transmission* such that each group of *signals* representing a *character* is preceded by a *start signal* and is followed by a *stop signal*.

| 8 |

start-up time: Period of time needed to reach a *steady-state operating condition* in the system from "start up".

| 11 |

static compliance: The maximum amount of displacement per unit of *load* applied to the *mechanical interface*.

| 1 |

static image: That part of a *display image*, such as a *form overlay*, that is not changed during a particular sequence of transactions.

| 9 |

[redacted]

| 1 |

stop signal: In *start-stop transmission*, a *signal* at the end of a *character* that prepares the receiving device for the reception of a subsequent character. NOTE - A stop signal is usually limited to one signal element having any duration equal to or greater than a specified minimum value.

| 8 |

storage tube: A type of cathode ray tube that retains a *display image* without requiring *refresh*.

| 9 |

string: A sequence of elements of the same nature, such as *characters*, considered as a whole.

| 6 |

stroke character generator: A *character generator* that generates *character* images composed of line segments.

| 9 |

stroke device: An *input* device that provides a set of coordinates that record the path of the device. Example: A *locator* that is sampled at a uniform rate.

| 9 |

sub level: In the operational structure of an NC system, the functional categories selected by the mode selector.

| 2 |

sub program: A segment of a *machine program* which can be called into effect by the appropriate machine control command.

[redacted]

surge: Temporary rise and fall of flow or pressure.

| 11 |

surge pressure: Pressure which results from a *surge*.

| 11 |

surge withstand capability: The capability of a device to remain functionally intact after exposure to overvoltages.

| 10 |

switching time: See 4.0.7.1. Switch-on time for an output going from the 0-state to the 1-state; switch-off time for an output going from the 1-state to the 0-state.

| 11 |

See 2.2.9.5. The initial point is the moment when the *control* or *pilot pressure* reaches the level of *switching pressure*; the completion point is when a given value of the *outlet pressure* has been reached.

| 11 |

symbol [character] [alphabetic] [binary digit] string: A *string* consisting solely of *symbols* [of *characters*] [of *letters* from the same *alphabet*] [of *binary digits*].

| 6 |

synchronous: Pertaining to two or more *processes* that depend upon the occurrence of events common to the processes.

| 4 |

synchronous transmission: *Data transmission* in which the time of occurrence of each *signal* representing a *bit* is related to a fixed time base.

| 8 |

system basic origin: Origin of the co-ordinates in the machine system.

| 2 |

system specification: Document detailing the materials, functional performance and standard of a piece of equipment or complete system or *installation* to meet the *performance specification*. The document will contain sufficient details to enable the manufacturer to select and determine the material and components necessary to fulfil the requirements of the customer and, conversely, to allow the customer to determine whether the products offered are to his satisfaction.

| 11 |

table: An arrangement of *data* each item of which may be identified by means of *arguments* or *keys*.

| 6 |

tablet: A special flat surface with a mechanism for indicating positions thereon, normally used as a *locator*.

| 9 |

tabulation block format: A *block format* in which the first *character* of each *word* is the *horizontal tabulation character* and in which words are presented in a specified order.

| 2 |

tabulation character: A non-printing *control character* that is used as the first *character* in each *word* other than the first word of a *block* in certain types of block format; it causes a tape-operated typewriter to set each word of control work in its own column when typed.

| 2 |

tandem data circuit: A *data circuit* that contains more than two *data circuitterminating equipments* in series.

| 8 |

tape preparation: The act of *transcribing* a *part program* onto a *punched tape* or onto a *magnetic tape*.

| 2 |

tape search: A facility of a *control system* that enables an operator to search for any desired *block* on the tape usually by means of a selector switch that causes the *tape reader* to search for the sequence number or the reference mark of the desired block.

| 2 |

task program: The set of motion and auxiliary function instructions which define the specific intended task of the *robot system* ; this type of program is normally generated by the user. Note : An application is a general area of work, a task is specific within the application.

| 1 |

task programming: The act of providing the *task program*. Note : In the present document "programming" means "task programming".

| 1 |

teach pendant: A hand held unit linked to the control system with which a robot can be programmed (or moved).

| 1 |

teach programming: Programming performed - by manually leading the robot *end-effector* - or by manually leading a mechanical simulating device - or by using a *teach pendant* to move the robot, through the desired actions.

| 1 |

technical process: A set of operations performed by equipment in which physical variables are monitored or controlled. Examples: distillation and condensation in a refinery; autopiloting and automatic landing in an aircraft.

| 10 |

temperature controller: Device which maintains the fluid temperature within prescribed limits.

| 11 |

threshold: Change of *input signal* required to produce a reversal in valve output at *null*, expressed as a percentage of *rated signal*.
| 11 |

threshold element: A *gate* that performs a *threshold operation*.
| 5 |

threshold values: The limiting values of the *dead band*.
| 2 |

thumb wheel: A wheel, rotatable about its axis, that provides a scalar value. NOTE - A pair of thumb wheels can be used as a *locator*.
| 9 |

time out: An event that occurs at the end of a predetermined period of time that began at the occurrence of another specified event. NOTE - The time out can be prevented by an appropriate *signal*.
| 8 |

to automate: To convert a *process* or equipment to *automatic* operation.
| 4 |

to code (deprecated in this sense): To design, write, and test *programs*.
| 4 |

to computerize: To *automate* by means of *computers*.
| 4 |

to digitize: To express or represent in a *digital* form *data* that are not *discrete data*. Example: To obtain a *digital representation* of the magnitude of a physical quantity from an *analog representation* of that magnitude.
| 7 |

to display: To present *data* visually.
| 9 |

to reset: To restore a device to a prescribed *initial position* that is not necessarily the zero condition.
| 2 |

tool centre point (TCP): Actual or virtual point defined for a given application with regard to the *mechanical interface coordinate system*.
| 1 |

tool diameter offset: A *tool offset*1) used for a rotary tool, in which the displacement is in the X *axis*1) or the Y axis1) or both and is equal to half the offset value.
| 2 |

tool function: A specification identifying or calling for a tool and other related *functions* in accordance with the appropriate *format* specification.1)
| 2 |

tool length offset: A *tool offset*, used for a rotary tool, in which the displacement is in the Z *axis*1) and equal to the offset value.
| 2 |

tool offset: A relative displacement that is applied to an axis of a machine for a specified portion or the whole of a program and causes a displacement in that axis only in the direction determined by the sign of the offset value. NOTE For example, tool offsets are typically applied in pairs of independent values for X and Z axes for tool tip location on turning machines, individually or in combination on milling or drilling machines.
| 2 |

tool path: The path described by a suitably defined point on a cutting tool.
| 2 |

tool path feedrate: The velocity, relative to the workpiece, of the tool reference point along the cutter path, usually expressed in units of length per minute or per revolution.
| 2 |

tool radius offset: A *tool offset* used for a rotary tool, in which the displacement in the X *axis*1) or the Y axis1) or both is equal to the offset value.
| 2 |

tracer control: Control operated by a system which follows the contours of master pattern.
| 11 |

tracker ball/gb/: A ball, rotatable about its center, that is used as an *input* device, normally as a *locator*.
| 9 |

tracking (in computer graphics): The action of moving a *tracking symbol*.
| 9 |

tracking symbol: A symbol on the *display surface* that indicates the position corresponding to the coordinate data produced by a *locator*.
| 9 |

transfer function: An expression of the relationship between the *input* and *output* values of a *control system* which describes its dynamic behaviour.
| 2 |

transient recovery time: Period of time required for a step input change in the pressure to damp out to within the desired operating band.
| 11 |

translating: Applying the same displacement to the position of one or more *display elements*.

| 9 |

transmission control character: A *control character* used to control or facilitate transmission of *data* between *data terminal equipments*. NOTE - Transmission control characters are described in ISO 646 and ISO 6429.

| 6 |

transmission line: The portion of a *data circuit* external to *data-circuit terminating equipment* (DCE), that connects the DCE to a *data switching exchange* (DSE), that connects a DCE to one or more other DCEs, or that connects a DSE to another DSE. NOTE - See figure 1.

| 8 |

tributary station: On a *multipoint connection* or a *point-to-point connection*, using *basic mode link control*, any *data station* other than the *control station*.

| 8 |

trigger circuit: A circuit that has a number of *stable states* or *unstable states*, at least one being stable, and is designed so that a desired transition can be initiated by the application of a suitable *pulse*.

| 5 |

tumbling: Dynamic *display* of the rotation of *display elements* about an axis the orientation of which is continuously changing in space.

| 9 |

turn-on stabilizing time: The time interval between the instant power is applied to a device and the instant at which the device performs according to its operating specifications.

| 10 |

two-way alternate communication: *Data communication* such that *data* is transferred in both directions, one direction at a time.

| 8 |

two-way simultaneous communication: *Data communication* such that *data* is transferred in both directions at the same time.

| 8 |

user class of service: A category of a *data transmission* service provided by a *data network* in which the *data signalling rate*, *the data terminal equipment* operating mode, and the *code* structure (if any) are standardized.

| 8 |

user coordinate: A coordinate specified by a user and expressed in a coordinate system that is device independent.

| 9 |

user facility: A set of functions available on demand to a user, and provided as part of a *data network* transmission service. NOTE - Some facilities may be available on a per-call basis, and others may be assigned for an agreed period of time at the request of the user. On certain assigned facilities, per-call options may also be available.

| 8 |

valuator: An *input* device that provides a scalar value. Examples: A *thumb wheel*, a potentiometer.

| 9 |

valve: Device which regulates the direction, pressure and flow of fluid used in *fluid power circuits*.

| 11 |

valve pressure drop: Sum of the differential pressures across the control orifices of the *output stage*. Valve pressure drop will equal the *supply pressure* minus the *return pressure* minus the *load pressure drop*.

| 11 |

variable block format: A *block format* in which the order of the *words* is specified but in which a particular word need only appear when specifying a new value, so that the number of the words in the *block* varies.

| 2 |

vector generator: A *functional unit* that generates directed lines segments.

| 9 |

velocity: Displacement covered by the point under consideration per unit of time.

| 1 |

viewing transformation: A mapping of the boundary and contents of a *window* into the boundary and interior of a *viewport* (see figure 2).

| 9 |

viewport: A predefined part of a *display space* (see figure 2).

| 9 |

virtual call facility: A *user facility* in which a call-set-up procedure and a callclearing procedure determine a period of communication between two *data terminal equipments* (DTEs) in which users' *data* are transferred in the network in the *packet* mode of operation. All the users' data are delivered from the network in the same order in which they are received by the network. NOTES 1 This facility requires end-to-end transfer control of packets within the network. 2 Data may be delivered to the network before the call set- up has been completed, but they are not delivered to the destination *address* if the call set-up attempts are unsuccessful. 3 Multi-access DTEs may have several virtual calls in operation at the same time.

| 8 |

virtual space (in computer graphics): A space in which the coordinates of the *display elements* are expressed in a device-independent manner (see figure 2).
| 9 |

window (in computer graphics): A predefined part of a *virtual space* (see figure 2).
| 9 |

wire frame representation: A mode of *display* showing all edges of a three-dimensional object without distinguishing *hidden lines*.
| 9 |

word: A *character string* considered as a unit for a given purpose.
| 6 |

word length: The number of *characters* in a *word*.
| 6 |

working space:: The set of *poses* relative to the *base coordinate system* which can be reached by the *wrist reference point*. The space in which the robot has no limitations in the movement of the *secondary axes* other than those imposed by the *joint* itself.
| 1 |

working stroke: Distance travelled by the piston in moving between two defined positions during actual operation.
| 11 |

world coordinate: A device independent cartesian coordinate used in the application program for specifying graphical input and output.
| 9 |

world coordinate system: A coordinate system referenced to earth or shop floor.
| 1 |

wraparound: Making that part of an image, which lies outside an edge of the *display space*, be displayed at the opposite edge of that space.
| 9 |

wrist reference point: The intersection point of the two innermost *secondary axes*, or if this does not exist, a specified point on the innermost secondary axis.
| 1 |

wrist secondary axes: An interconnected set of links and powered joints between the *arm* and *end-effector* which supports, positions and orientates the end-effector.
| 1 |

zero offset: A characteristic of a *numerical control* system that permits the origin of the numerical control measuring system to be shifted over a specified range with respect to the *machine datum*, the location of the permanent origin being stored in the numerical control system.
| 2 |

zooming: Progressively *scaling* the entire *display image* to give the visual impression of movement of all or part of a *display group* toward or away from an observer. NOTE - The scaling value should be the same in all directions.
| 9 |

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Annex A
(informative)

Source documents for industrial automation glossary

[1] ISO/TR 8373 : 1988, *Manipulating industrial robots — Vocabulary.*

[2] ISO 2806 : 1980, *Numerical control of machines — Vocabulary.*

[3] ISO 445 : 1984, *Pallets for materials handling — Vocabulary.*

[4] ISO 2382-1 : 1984, *Data processing — Vocabulary — Part 01: Fundamental terms.*

[5] ISO 2382-3 : 1987, *Information processing systems — Vocabulary — Part 03: Equipment technology.*

[6] ISO 2382-4 : 1987, *Information processing systems — Vocabulary — Part 04: Organization of data.*

[7] ISO 2382-5 : 1974[1], *Data processing — Vocabulary — Part 05: Representation of data.*

[8] ISO 2382-9 : 1984, *Data processing — Vocabulary — Part 09: Data communication.*

[9] ISO 2382-13 : 1984, *Data processing — Vocabulary — Part 13: Computer graphics.*

[10] ISO 2382-21 : 1985, *Data processing — Vocabulary — Part 21: Interfaces between process computer systems and technical processes.*

[11] ISO 5598 : 1985, *Fluid power systems and components — Vocabulary.*

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[1] Definitions in this Technical Report are those given in ISO 2382-5 : 1974. However, this International Standard was revised in 1989 and the definitions may no longer be the same.

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